Phytochemical Profile and biological activities of Clerodendrum infortanutum Linn

Dubey Jitendra [1*], Ms. Devi Himani[1], Kaur Bakchhinder [2], Dr. Bhatt Manvi [3]

1 Research Scholar. B. Pharma, School of Pharmacy and Research, DBUU, Dehradun,
2 Assistant Professor (Pharmaceutical Chemistry), School of Pharmacy and Research, DBUU, Dehradun
3 Research Scholar. B. Pharma, School of Pharmacy and Research, DBUU, Dehradun
4 Assistant Professor, School of Pharmacy and Research, DBUU, Dehradun

Email id: 1. jitendarkumardubey65@gmail.com, 2. himanighildiyal72@gmail. Com 3.bakchhinderkaur12341234@gmail.com, 4.manvibhatt05@gmail.com

Corresponding author
Name : Himani devi
Contect no: 7895164934
Email: himanighildiyal72@gmail. com
Postal address : veer Bhadra colony , Psulok RISHIKESH(Uttarakhand 249203

ABSTRACT

Clerodendrum infortunatum Linn. is one of the most important herbal medicinal plant that is frequently used for its medicinal qualities these plant are belongs to the Verbenaceae family. It is generally beneficial for the tonic and has anthelmintic properties inside rural north India. That is describe to have an active bitter component called clerodin. While Clerodendrum infortunatum is extensively used in Ayurveda, Unani, medicine, and homoeopathy to treat ailments like diarrhoea, skin diseases, venereal and scrofulous ailments, wounds, and post-natal complications, it is also used as a vermifuge, laxative, and cholagogue. Among other things, it is used to expel ascarids from the anus and as a topical treatment for tumors. Further research is needed to find out the exact medicinal advantages of these herbs. Clerodendrum infortunatum is utilized to treat tumors externally because its leaves and root contain a sterol known clerosterol also other compound including clerodone and clerodol. Extract from the roots and leaves have potency to cure fresh wounds. Leaf extract of this plant had been visible to notable enhance hemoglobulin levels, decrease blood sugar levels in diabetic patients and also effective against piles. Painful area of the body can be greatly relived in 12 hours by applying slightly warned leaves infused with edible oil. Root extract of these plant also have been identified seven sugar molecule like fructose, lactose, galactose, glucose, maltose, sucrose, raffinose. Pollen viability of this plant was determined by the hanging drop method and reproductive success was evaluated based on fruit and seed production.

Keywords: Clerodendrum infortunatum, anthelmintic, diabetes, anti-cancer

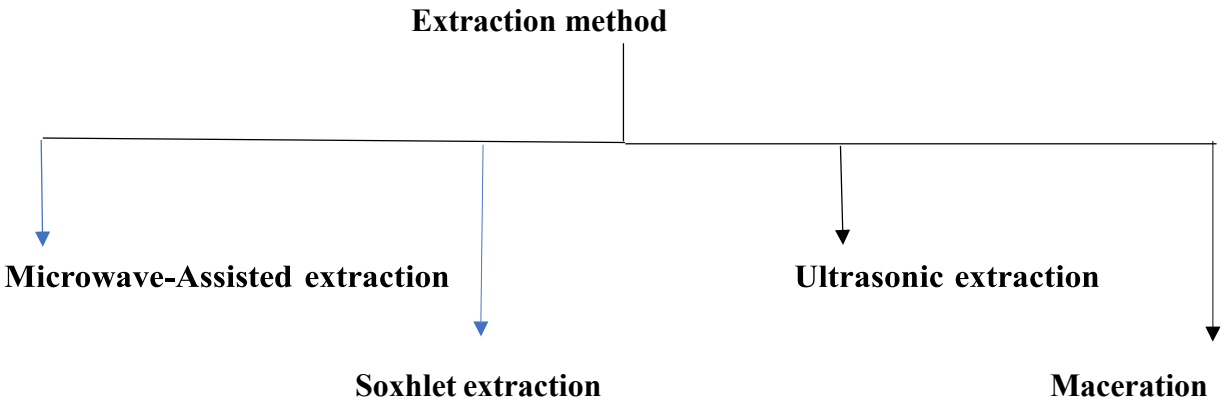
INTRODUCTION

Plants have been extensively utilized for a variety of purposes, including food, animal feed, medicine, flavouring enhancer, developing materials, and colourant. In global world, crops became utilized by conventional medicine practitioners to cure human and animal illness. Ayurvedic, Unani, Siddha, Chinese are among the medicinal system that utilize various plant species to make better health and prevent infection, illness and other condition. Harbel based medicine is used the primary source of healthcare in different

African countries as well as commonwealth like Sri Lanka, Japan, Malaysia, India, China, Bangladesh, Thailand, Japan, Bhutan, Taiwan, Pakistan. Plant are important source of Bioactive molecules or secondary metabolite obtained by plant metabolic pathway like shikimic acid & malonate/acetate pathway which hold potential medicinal use. Certain drug such as quinine, morphine, codeine, vincristine, vinblastine, digoxin, and artemisinin are derived from the plant. different nation of the global now utilize medicinal plant as a way to generate income .

Clerodendrum infortunatum Linn. is the most valuable medicinal plants belong to Verbenaceae family that has been used as medicine in India for centuries. Different species of clerodendrum genus like C. trichotomum, C. bungei, C. inerme, C.philippinum, C. fragrans, C. infotunatum,

C. splendens, C. volkameria. Etc has been utilised for number of years and experimentation has already demonstrate their antioxidant, hepatoprotective efficacy. ethnic group employ different fragments of these plant to treat tumours, some skin condition, stings, colic and snake bite. They are also used to treat reduce inflammation, and have better potency to cure small pox illness. As well, Indian system of medicine put to use various part of the plants to cure fever, asthma, anti-oxidant, anthelmintic, antiviral, antibacterial, antifungal, and insecticidal illness.extractin



CLERODENRUM INFORTUNATUM:- PLANT MORPHOLOGY

The plants have lenticellate stems that are hollow, greyish, and very hairy. The also have swollen nodes and then, quadrangular branchlets. The bark has a corky, grey colour. The leaves have 6-9 lateral veins on either side of the midvein and are simple, opposite, widely, cordate or ovate with full edge. With a slightly paler villous ventral side and dark -Green tomentose dorsal side , the acuminate leaf apex is visible with length of 3 to 15 cm, the petiole is elongated, slender, cylindrical, and heavily hairy. The terminals panicles of the inflorescence have 6 to 14 cymes. They have quadrangular peduncles that are around 5cm long, densely pubescent elliptic foliaceous bracts, and caduceus bractlets, snow-white, tubular, and mildly scented flowers are present. The zygomorphic, bisexual flowers have a thin , 1-2cm long pedicel. The calyx of this plant is five -toothed, divided, pubescent and lanceolate. The corolla is hypocrateriform and pentalobed, with four lobes on one side one top significantly larger lobe. The corolla are elliptic, white and pubescent, with a pinkish throat and a sharp apex. The corolla tube is slender, cylinder, and about 1.5 to 2 cm long. Androecium consists of four exserted stamens that are didynamous to subequal, filiform filaments that are elliptical and bilobed. The ovary is oblong, quadra lobed, quadra-loculed, with a filiform style and a small 2-fid stigma that make up the gynecium. Shallow cupular, pinkish calyx and metallic blue dupes with a diameter of approximately 1 to 1.5 cm are produced by the plant . the most prevalent source of bioactive phytochemicals is the leaves and fruits turn purplish-black colour when ripens.

Figure(a)C.Infortunatum

Table no: 1

Genus	Clerodendrum
Family	Verbenaceae
Synonym	Clerodendrum visosum vent clerodendr
Clade	Angiosperm
Species	Clerodendrum infortunatum
Kingdam	Plantee
Hight	1-5 meters
Taste	Bitter taste
Colour	Green (flawer colour-white)

ACTIVE PHYTOCONSTITUENTS IN C. INFORTUNATUM

C. Infortunatum plants are produced a broad category of chemicals compounds that are mention to as bioactive chemical compounds. These compound are secondary in nature (secondary metabolite) and have a valuable impact on an individual health. Among the secondary metabolite created through the plants included as flavonoids, terpenes, alkaloids, and polyphenolic chemicals. Secondary metabolite in plants are significant and provide a variety of functions such as protecting the herbs through the parasite, diseases, and animal as well as adding aroma and brilliant colour that can helping in conjugation. Plants active metabolite is amenable for the medicinal capability, as isolated phytochemicals possess a diverse array of bioactivities. Detect and quantify phytochemicals of C.infortunatum investigate various part of this plant by many method such as standard phytochemicals analysis Large number of chemical compound has been detected find out in C. infortunatum like as hexadecenoic acids, limonene,

squalene, dodecanoic acid, vitamin E, hydroxy-methyl-furfural, stigma-sterol, cinnaminic acid, O-methoxy-phenol, 4,allyl-2-methoxy-phenol, 4-hydroxy-3methoxybenzoic acid through GC-MS analysis. In this plant also detect the three clerodane diterpenes known as Clerodin, 15-Methoxy-14,15-dihydroclerodin and 15-hydroxy-14-15dihydroclerodin these compound possess insecticidal activity. The ethanolic extract of the C. infortunatum root have been estimated they contain about 1.4% w/w of alkaloids. Through the Foiin-denis assay estimated that the 166. 607mg tannic acid identical /g to dried extract of root bark of this plants. Numerous details regarding the different phytoconstituents seen in various plant section as well as the structure of some of the compound in table.

S. NO.	**PART Of PLANT**	**ACTIVE CONSTITUENTS**	**PHARMACOLOGICAL ACTION**	**REFERENCE**
1	Root	Alkaloids, flavonoids, terpenoids, glycosides	Inhibition of bacterial growth, treatment of diarrhea	Haris et al 75
2	Root	Tannin, flavonoids, saponins, steroids	They are act as antioxidant & anticancer agent, antibacterial, development of steroidal drug	Sumi et al. 78
3	Root	Quercetin	Acts as strong anti -bacterial agent, Also have anti-inflammatory activity, and these compound have wide pharmacological action	Chacko et al. 84
4	Root	Tannins, phenols	Antifungal Anti-oxidant	Helen et al.74
5	Root	Alkaloids, tannins and flavonoids	Anti-bacterial and have moderate action against malarial	Joly. et al. 87
6	Root	Alkaloids, flavonoids, terpenoids, cardiotonic steroids, tannin & polyphenols	Prevent bacterial, treat heart related problems, anti-oxidant, antifungal	Prusty et al.88
7	Root	Clerodolone, clerodone, clerodol and clerosterol	Microbial infection, cytotoxicity and anti-inflammatory, (158)	Manzoorkhuda and sarela. *et al.* 93
9	Leaf	Gallic acid	Neuroprotective, antioxidant used in food industry, diabetes, IBD, gastric ulcer It inhibit HIV-1 integrase, HIV-1trandcriptase, HIV-1 protease dimerization (18-22)	Verma and gupta. *et al.* 68

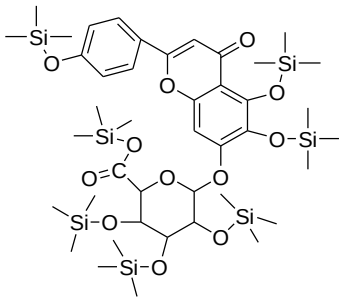
10	Leaf	Sterols, tannins, saponins, terpenoids, and flavonoids	Treat fever and malarial fever. Respiratory disorder, reduced inflammation	Verma and gupta. *et al.* 68
12	Leaf	Tannin, terpenoids, alkaloids, flavonoids, steroids, phenolics compound	Fever, microbial infection, development of steroidal drug, antioxidant	Dey et al.79
13	Leaf	Phytosterols	Reducing unwanted effects of male hormones Antibacterial property, cancer prevention, managing cholesterol	Florence et al. 81
15	Leaf	Beta-sitosterol	Anti-inflammatory, antioxidant, anti-diabetic, antimicrobial, immunomodulatory Anticancer. hepatoprotective	Gupta and singh *et al.* 83
16	Leaf	Oleanolic acid, Clerodinin A	Anticancer activity, antioxidant, anti-aging, improve the skin health	Sannigrahi et al 67
20	Seeds	Quercetin	Acts as strong anti -bacterial agent, Also have anti-inflammatory activity, and these compound have wide pharmacological action	Eluru & koumaravel ou et al (Placeholder1) (Placeholder2) (K. Gouthamchandra, 2010)
22	Flower	Apigenin, acacetin, acacetin -7-0-glucuronide	Antibacterial, antifungal, anti inflammatory, anti oxidant.	Sihna et al 90

Pharmacological Action:

Hepatoprotective activity

Clerodendrum infortunatum Linn. its methanolic extract was examine for its capability to reduce hepatotoxicity produced by the carban tetrachloride (CCL4) in mice. alkaline phosphatase (ALP), bilirubin & entire glutamate pyruvate transaminase (ALT) glutamate oxaloacetate transaminase (AST) have being surrounded in vital fluid biochemical markers inspect throughout this investigation. The hepatoprotective ramification of the methanol educe was additionally vindicated along the histological studies, as the liver buildings design of the

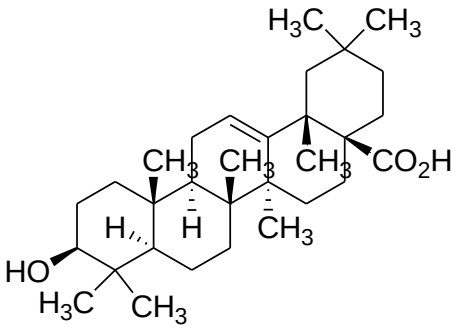
normal rats remain stable intact without any abnormalities. This study is demonstrated that the methanolic extract of clerodendrum infortunatum has modest protective effect on the liver. The liver protective effect of the methanol extract of C.infortunatum may be attributed to the flavonoid(like scutellarein-7-0-glucuronide) terpenoids, and saponin present in the extract.



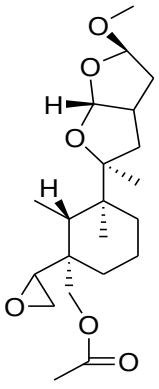
Scutellarein-7-0-glucuronide

Anticancer Activity

The ethanolic extract of C. infortunatum contain some most important phytoconstituents like oleanolic acid and clerodinin A and these components are identified by the HPLC analysis of the MECI (Middle east children`s institute). These compound shows anticancer efficacy opposed to Ehrlich `s ascites carcinoma (EAC) in swiss albino mice. Treatment by the MECI results in a marked reduction in the volume of tumour cell and an extension of their life span of the mice. The EAC control group's median survival time (MST) was 19.42 ± 0.91 ± days, while the MST for the MECI treated groups was 23.44 ± 2.69 days and 27.57 ± 2.57 days. In the alcoholic extract (21)



Clerodinin A

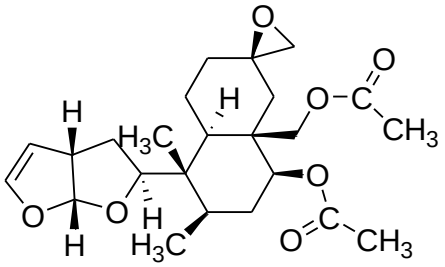


oleanolic acid

Anthelmintic activity

The anthelmintic activity of an alcoholic and aqueous extract of the dried leaves powdered of the C. infortunatum was investigated against Pheretima posthuman (collected from the moist

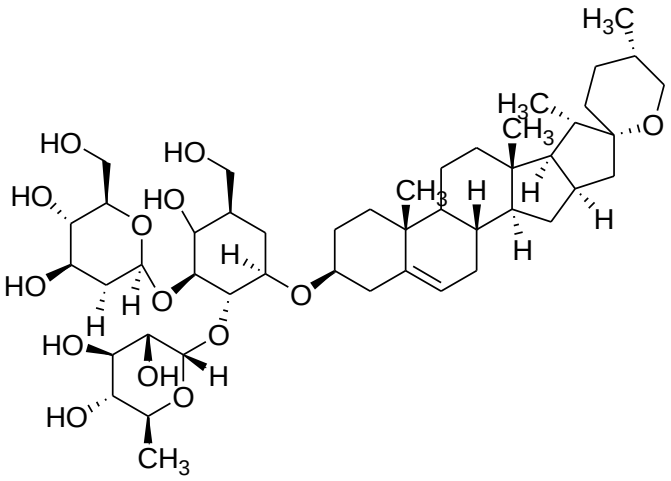
soil, measuring 3-5 cm in length & 0.1-0.2 cm in width) at different concentration in order to find out the paralysis and death of the worms. Distilled water was used as the control and piperazine citrate(anthelmintic) used as standard. The results showed that the alcoholic extract produce both death and paralysis of the worms in a shorter time compared to piperazine citrate, notably at higher concentration. However the aqueous extract exhibit comparable activity. These activity is due to the alcoholic and aqueous extract contain diterpenoids like clerodin



Clerodin

Analgesic activity

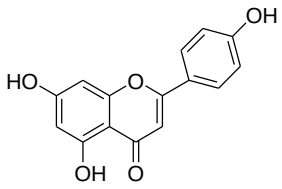
Saponin obtained from the fresh leaves of C infotunatum expose defence against writhing induced by acetic acid in mature albino mice taking acetylsalicylic acid, acetaminophen and morphine sulphate as standard. At various concentrations, the viscid like molecule is carid out from the uncoloured mixture of the saponin with the help of mixing petroleum ether was applied. Analgesia effect was produced in a dose dependent way. After the first investigation, the creature have being given a varying quantity of saponin using hot plate system proceed towards to cure physical harm aspirin & pentazocine was utilised as the benchmark. The extraction of whole plant magnify the effect of acetylsalicylic acid and pentazocine and produce powerful analgesic activity at low concentration



Saponin

Wound Healing Activity

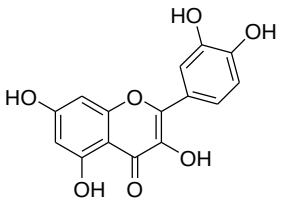
Extract of clerodendrum infortunatum like ethanolic and chloroform both have ability to heal the wounds was estimated in the experimental rats. 4% (w/w) ointment cream bases of ethanolic, petroleum ether and chloroform extract are formulate for the topical application And these extract have potency to promote the wound healing activity was evaluate. Animal treated with ethanol and chloroform extract displayed significant wound healing, comparable to the reference standard medication nitrofurazone. The wound healing process of these extract because in the extract contain secondary bioactive compound like flavonoids and polyphenols and these bioactive compounds have antibacterial and anti-oxidant properties.([4])



Apigenin

Antibacterial Activity

The 80% ethanolic extract of clerodendrum infortunatum of the leaves, showed significant inhibitory activity at concentration 25mg/ml against some clinical strains bacteria like Escherichia coli, pseudomonas aeruginosa, staphylococcus aureus, while bacillus subtilis was suppressed at concentration about 6.25 mg/ml. and on the other hand the 80% ethanolic extract of the root at 12.5mg/ml showed inhibition of bacillus subtilis, however it was found to be ineffective against Escherichia coli , pseudomonas aeruginosa, and staphylococcus aureus. And these activity occur due to the presence of various secondary metabolites like flavonoid (Quercetin, apigenin, scutellria Acts as strong anti -bacterial agent), phenolic compound, alkaloids terpenoids etc.

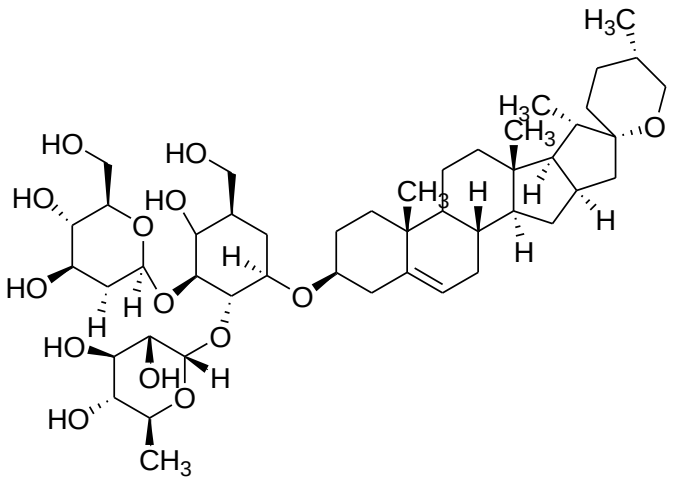


Quercetin,

Anticonvulsant Activity

Saponin is a secondary metabolite that is extracted from the leaves of clerodendrum infortunatum and it also demonstrated anticonvulsant properties. These property was estimated by the inducing seizures through leptazol. Saponin was given by the intraperitoneally at different dose (20 to 100mg/kg body wt). results is SN(saponin)reduced the duration of seizures

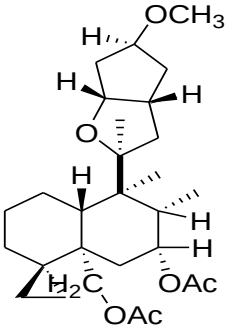
and provided dose dependent protection against leptazol induced convulsions. The results indicated that the saponin possesses notable anticonvulsant impact ([4,10])



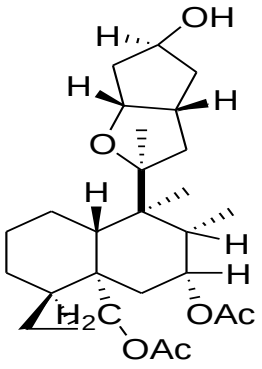
Saponin

Insecticide Activity

Many investigation explored the insecticidal activity of different part clerodendrum infortunatum. Abbaszadeh et al. point out three clerodane diterpenoid—clerodin, 15- methoxy-14,15-dihydro-clerodin & 15-hydroxy-14,15-dehydro-clerodin from the different part of plant which is responsible for the producing insecticidal properties in opposition to Helicoverpa armigera together with Gl50 value of 11, 13, and 21 parts per million, in the order given. A further study demonstrated that the addition of leaf powder to cow dung (5, 10, and 20% w/w) be the cause of dose dependent rate of mortality in oryctes rhinoceros grubs and had a deleterious effect om the male insect reproductive. The powder of leaf additionally indicate dose dependent insecticidal properties on the larvae of Odoiporus longicollis with LD50 3.987%



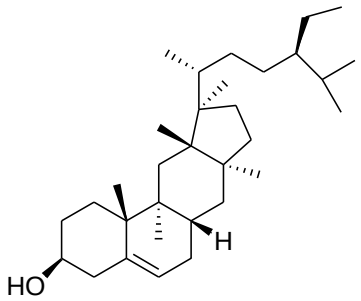
15- methoxy-14,15-dihydro-clerodin



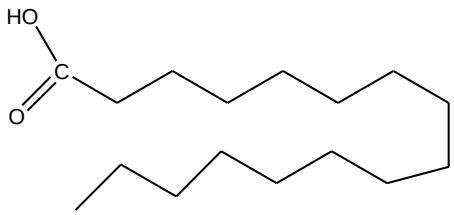
15-hydroxy-14,15-dehydro-clerodin

Anti-inflammatory Activity

An critical inflammatory reaction induced due to carrageenan in wistar rats was inspection employing a methanolic extract of C. infortunatum leaves. This inspection disclose that antiinflammatory activity were estimated utilizing phlogistic agent (histamine and dextran) after the study show that the extraction reduced the inflammation compared to reference drug phenylbutazone. These activity produced due to extract contain various bioactive molecule like beta-sterol, sitosterol, botulin, n-hexadecanoic acid etc.



Beta.Sitosterol



n-hexadecanoic acid

Conclusion

Many pharmacological property exhibit by the plant as indicated by the in-vitro and in vivo examination and notable medicinal efficacy over a various regions were the results of an comprehensive review on many aspect C infortunatum. The traditional employment of the plant through dissimilar indigenous populations have been authenticated throughout the investigation. Many plant bioactive agent that have been connected to the plant announce biological activity identified. Overall, it give the impression of being C infortunatum is a plant that may be utilize to obtain therapeutic drugs for a many illness and problems.

Reference

(1) **Bhaskar, D., Dilip, P., & Arindam, H.** (2014). *A review on biological activity and medical properties of Clerodendrum infortunatum Linn.* International Journal of Pharmacy and Pharmaceutical Sciences, **6**(10). ISSN: 0975-1491.

(2) Chowdhury, G**.** (2017). *Preliminary phytochemical screening and evaluation of anti-inflammatory activity of ethanolic extract of leaves of Clerodendrum infortunatum.* International Journal of Current Pharmaceutical Research, **9**(4). ISSN: 0975-7066.

(3) Raghavendra, H. L., Kekuda, T. R. P., & Dhanya Shree, V. S. (2019). Ethnobotanical uses, phytochemistry and pharmacological activities of Clerodendrum infortunatum L. Journal of Delivery and Therapeutics, 9(2), 547-559.

(4) Bhattacharjee, D., Das, A., & Chakraborthy, G. S. (2011). Clerodendrum infortunatum Linn. Journal of Advances in Pharmacy and Research, (3). ISSN: 2231-6817.
(5) Akhil, B. S., Sujathan, K., & Lekshmi Asha. (2021). Clerodendrum infortunatum Linn: An unheeded of nature. International Journal of Pharmaceutical Sciences Research, 12(12). ISSN: 0975-8285.
(6) Akhil, B. S., Radhakrishnan, K., & Guruvayoorappan, C. (2023). Exploring the phytochemical profile and biological activities of Clerodendrum infortunatum. ACS Omega, 8, 10383-10396.
(7) Shrivastava, N., & Patel, T. (2007). Clerodendrum and healthcare: An overview – Part II Phytochemistry and biotechnology. Medicinal and Aromatic Plant Science and Biotechnology, Global Science.
(8) Singh, D., Saini, R., & Patil, S. (2024). Qualitative investigation and screening of antimicrobial activity of stem extract of Clerodendrum infortunatum plant. Journal for Research in Applied Sciences and Biotechnology, 3(3), June. ISSN: 2583-4053.
(9) Khan, S. A., Shahid, S., & Ahmad, W. (2017). Pharmacological importance of Clerodendrum genus. International Journal of Pharmaceutical Science and Research, 2(2), March. ISSN: 2455-4685.
(10) Pal, D. K., Sannigrahi, S., & Mazumder, U. K. (2009). Anticonvulsant and analgesic effects of saponin isolated from the leaves of Clerodendrum infortunatum Linn. in mice. Indian Journal of Experimental Biology, 47(9), 743-747.
(11) Pal, D. K., Sannigrahi, S., & Mazumder, U. K. Hepatoprotective potential of methanol extract of Clerodendrum infortunatum Linn. against CCl4-induced hepatotoxicity in rats.
(12) Khadabadi, S. S., Deore, S. L., Kubde, M. S., & Modi, A. J. (2010). Antioxidant effects of leaves of Clerodendrum infortunatum. International Journal of Pharmaceutical Sciences and Research (IJPSR), 1(4).
(13) Goswami, A., Dixit, V. K., & Srivastava, B. K. (1998). Antimalarial trials on herbal extracts I: Clerodendrum infortunatum L. Bionature, 18(2), 45-49.
(14) Banerjee, H. N. (1936). Preliminary note on clerodin from Clerodendrum infortunatum. Science & Culture, 2, 163; Botany, 5, 271-290.
(15) Banerjee, H. N. (1937). Chemical examination of Clerodendrum infortunatum. Part I. Journal of Indian Chemical Society, 14, 51-57.
(16) Rajkumar, B. M. (2010). Morphological study and medicinal importance of Clerodendrum infortunatum. Asian Journal of Pharmaceutical Research and Health Care, 2(2), April, 216-220.
(17) Rej, S., Dutta, M., & Jamal, S. (2014). Study of phytoconstituents and antibacterial activity of Clerodendrum infortunatum. Asian Journal of Research in Pharmaceutical Science, 4(4), 187-195.
(18) Kuluvar, G., Mohmood, R., & Khadeer, M. B. (2009). Wound-healing activity of Clerodendrum infortunatum. International Journal of Biomedical and Pharmaceutical Sciences, 3(1), 21-25.

(19) Prusty, A. K., Ghosh, T., & Sahu, S. K. (2008). Anthelmintic, antimicrobial and antipyretic activity of various extracts of Clerodendrum infortunatum Linn. Oriental Pharmacy and Experimental Medicine, 8(4), 374-379.

(20) Das, S., Haldar, K. P., & Pramanik, G. (2010). Evaluation of anti-inflammatory activity of Clerodendrum infortunatum Linn. Global Journal of Pharmacology, 4(1), 48-50.

(21) Sannigrahi, S., Mazumder, U. K., Pal, D. K., & Mishra, S. L. (2012). Terpenoids of methanol extract of Clerodendrum infortunatum exhibit anticancer activity against Ehrlich's ascites carcinoma in mice. Informa Healthcare Pharmaceutical Biology. ISSN: 1388-0209.